DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to an effective variable length packet correspondence procedure and packet communication device with the wireless communication network that an error ratio changes every moment like a mobile communications network.
[0002]
[Description of the Prior Art]In recent years, the second generation mobile communication system characterized by digital communications is spreading quickly. For example, PHS (Personal Handy Phone System) adopts a TDMA/TDD (Time Division Multiplex Access/Time Division Duplex) method, Since it has 32k bps transmission capacity by one slot, a sound, data, and not only a still picture but video can also be transmitted, and it is greatly expected as an infrastructure which realizes mobile multimedia communication.
[0003]The ARQ (Automatic Repeat Request) error correcting method of the conventional SR method is explained referring to a figure. Drawing 7 is a figure showing the packet composition at the time of the conventional usual transmission, and the packet composition at the time of resending. Drawing 8 is a figure showing the data flow between the data source of a GBN (Go Back N) method, and a data receiving side. Drawing 9 is a figure showing the data flow between the data source of SR (Selective Repeat) method, and a data receiving side. Drawing 10 is a figure showing the data flow between the data source of SR (Selective Repeat) method of the conventional variable length packet, and a data receiving side. Drawing 11 is a figure showing the data flow between the data source of the GBN (Go Back N) method of the conventional variable length packet, and a data receiving side.
[0004]In the conventional ARQ error correcting method, the case where not a fixed length packet but a variable length packet is used is explained. Generally, the meaning using a variable length packet earns a throughput by enlarging a packet size, when the rate of an error

generation is low in a communications network, and when the rate of an error generation is high, it is reducing the number of times of resending failure by making a packet size small. For this reason, when "request sending" is received, it is desirable to judge that the rate of an error generation is high, and to make a packet size small.

[0005]If the case where variable length packet communication is used by a GBN method like drawing 11 is explained, When an error occurs in the packet of transmission order number N (S) =5, when a data receiving side receives the packet of following transmission order number N(S) =6, it detects sequence number disagreement, and transmits "request sending" (Reject) to a data source. The packet of N(S) =9 is discarded from transmission order number N(S) =6 received by the data receiving side by the time the data source received "request sending" (Reject).

[0006]When a data source receives "request sending" (Reject), he resends the packet of transmission order number N(S) =5. The packet of transmission order number N(S) =5 resent at this time makes the packet size small by dividing the packet of transmission order number N (S) =5 of the basis transmitted at the time of an error generation, and resending the part of them (here, it trichotomizes).

[0007]And the two divided remaining packets are resent as the packet of transmission order number N(S) =6, and a packet of transmission order number N(S) =7. The figure showing the situation of the division at this time is drawing 7.

[0008]And after a data source divides the packet of transmission order number N(S) =5 of a basis and resends as N(S) =7 from transmission order number N(S) =5, he transmits the packet of transmission order number N(S) =6 of a basis as a packet of transmission order number N(S) =8 anew.

[0009]The packet of transmission order number N(S) =7 of a basis, N(S) =8, and N(S) =9 is similarly transmitted as transmission order number N(S) =9, N(S) =10, and N(S) =11. Such variable length packet communication was performed by the GBN (Go BackN) method.

[0010]Thus, transmission of a new packet is possible for not waiting for the confirmation of receipt from a data receiving side in a GBN method. Since all the packets sent out after the packet concerned are again sent out when the request sending of an error packet arrives, while control is simple, transmission efficiency falls.

[0011]For example, in the example shown in drawing 8, when an error occurs in the packet of transmission order number N(S) =5, when a data receiving side receives the packet of following transmission order number N(S) =6, it detects sequence number disagreement, and transmits "request sending" (Reject) to a data source.

[0012]When a data source receives "request sending" (Reject), the packet of transmission order number N(S) =5 is resent, and this is received by a data receiving side. The packet of N (S) =9 is discarded from transmission order number N(S) =6 received by the data receiving

side in the meantime. And a data source resumes transmission from transmission order number N(S) =6 anew, after resending the packet of transmission order number N(S) =5. For this reason, a resending time delay is long and the return to a communicating state usually takes time.

[0013]There is an SR (Selective Repeat) method shown in drawing 10 as other methods. Delivery of a new packet is possible also for this SR method for not waiting for the confirmation of receipt from a receiving station.

[0014]SR method differs from a GBN method in that only an error frame is resent. While it is the most efficient method, control becomes complicated a little. When an error occurs in the packet of transmission order number N(S) =5 like drawing 9, when a data receiving side receives the packet of following transmission order number N(S) =6, it detects sequence number disagreement, and transmits "request sending" (Selective Reject) to a data source.

[0015]When a data receiving side receives "request sending" (Selective Reject), the packet of transmission order number N(S) =5 is resent, and this is received by a data receiving side. The packet of N(S) =9 is stored temporarily from transmission order number N(S) =6 received by the data receiving side in the meantime. And a data source resends only the packet of transmission order number N(S) =5. Then, a data source resumes transmission from the packet of transmission order number N(S) =10. For this reason, resending delay is short and the return to a communicating state is usually earlier than a GBN method.

[0016]For example, when an error occurs by the packet of transmission order number N(S) =5 in the example shown in drawing 10, When a data receiving side receives the packet of following transmission order number N(S) =6, it detects sequence number disagreement, and it transmits "request sending" (SelectiveReject) to a data source.

[0017]The packet of N(S) =9 is stored temporarily from transmission order number N(S) =6 received by the data receiving side by the time the data source received request sending (Selective Reject). When a data source receives request sending (Selective Reject), he resends the packet of N(S) =5. The packet of transmission order number N(S) =5 resent at this time, The packet of transmission order number N(S) =5 of the basis transmitted at the time of an error generation as shown in drawing 7 is divided (here, it trichotomizes), and the two divided remaining packets are resent as the packet of transmission order number N(S) =6, and a packet of transmission order number N(S) =7.

[0018]

[Problem(s) to be Solved by the Invention]However, in the conventional SR method, the transmission order number of the packet of transmission order number N(S) =6 by which division resending was carried out with the packet of transmission order number N(S) =6 which is transmitted in front and stored temporarily, and N(S) =7, and N(S) =7 is in agreement, and the following faults occur.

[0019]That is, since the packet of N(S) =6 and N(S) =7 sent regularly is already made finishing [reception] in the data receiving side as shown in drawing 10, the packet of N(S) =6 by which division resending was carried out later, and N(S) =7 will be discarded as sequence number disagreement. And the request sending (Selective Reject) of transmission order number N(S) =10 may be transmitted to a data source. Simultaneously, a data receiving side may connect the packet of transmission order number N(S) =6 which it was before transmitted and was stored temporarily after the packet of transmission order number N(S) =5 by which division resending was carried out, and lack of data may produce it.

[0020]It is this invention's solving an aforementioned problem, forming a resending identification flag in a packet, and setting a sub transmission order number as a resending packet, Also when performing the ARQ (Automatic Repeat Request) error correction of SR (Selective Repeat) method, It aims at providing the variable length packet correspondence procedure and packet communication device divide into a small packet and it enabled it to resend.

[0021]

[Means for Solving the Problem]So that this invention may form a resending identification flag in a packet and can divide and resend it to a smaller packet with the same sequence number to achieve the above objects, In order to provide a sub transmission order number in a resending packet and to identify that it is a resending packet of the last of the same sequence number, a resending packet ending flag is formed.

[0022]According to this this invention, also when performing an ARQ (Automatic Repeat Request) error correction of SR (Selective Repeat) method, variable length packet communication can be performed.

[0023]

[Embodiment of the Invention]When performing the ARQ (Automatic RepeatRequest) error correction of SR (Selective Repeat) method, the invention of this invention according to claim 1, The communication packet at the time of communication (at the time of un-resending) Usually, an opening flag, an ending flag, Comprise a transmission order number, a resending identification flag, data, and a CRC error detecting code, and the communication packet at the time of resending, An opening flag, an ending flag, a transmission order number, a resending identification flag, It comprises a sub transmission order number, a resending ending flag, data, and a CRC error detecting code, It is shown that it is a division resending packet by activating a resending identification flag at the time of resending, Resending with a smaller packet size is enabled by establishing a sub transmission order number for every divided data, It is the variable length packet correspondence procedure which showed the end of division resending with the resending ending flag, When the rate of an error generation is low in a communications network, a throughput is earned by enlarging a packet size, and when the rate

of an error generation is high, it has the operation that the number of times of resending failure is reducible, by making a packet size small.

[0024]The transmitted data amount measuring means which the invention of this invention according to claim 2 measures the data volume of send data in a transmission section, and outputs a transmitted data amount, The error detecting code operation part which calculates the error detecting code of send data, and a packet size determination means to determine a packet size based on the existence of a transmitted data amount and the request sending message which received, The transmission order number counter which makes a number increase by every [1] whenever one packet of send data is inputted, and outputs a transmission order number, The transmitting sub sequence number counter which makes a number increase by every [1] whenever one packet of send data is inputted, counts up the transmitting sub sequence number one time, and outputs a transmitting sub sequence number counter value, The data storage memory for resending which outputs the data of the sequence number applicable when the data to transmit is saved and the sequence number by which request sending was carried out is inputted as the sequence number preservation memory for resending as retransmits data, The multiplexing means which multiplexes send data, an error detecting code, a transmission order number, and the transmitting sub sequence number based on the packet size outputted from the packet size determination means, and is outputted as transmitting multiplexing data, It has a change-over switch which switches the data given to said multiplexing means as a transmission order number, and an RF module, A separation-ized means to divide reception multiplexing data into an error detecting code, received data, the receiving sequence number, and the receiving sub sequence number in a receive section, The error detecting code operation part which calculates an error detecting code based on received data, and outputs the error detecting code result of an operation, The error detecting code comparator which compares the error detecting code and the error detecting code result of an operation which were received, and outputs an error detecting code comparison result, The receiving sequence number comparator which compares the receiving sub sequence number and the receiving sub sequence number of a counter output value which compared the receiving sequence number and the receiving sequence number of a counter output value which were received, and were received, and outputs a receiving sequence number comparison result, The receiving sequence number counter which makes the receiving sequence number increase by every [1] whenever it receives one packet of data while said receiving sequence number comparator is not outputting request sending, and outputs the receiving sequence number, The receiving sub sequence number counter which makes the receiving sub sequence number increase by every [1] whenever it receives one packet of data only about retransmits data, and outputs the receiving sub sequence number, The switch which sends the received data inputted by becoming one to the next step when it

becomes off when the comparison result of said error detecting code comparator shows those with an error, and an error detecting code comparison result shows those without an error, When the comparison result of a receiving sequence number comparator is inharmonious, become OFF, and when a receiving sequence number comparison result is coincidence, it has a switch which sends the received data inputted by becoming one to the next step, A receiving sequence number comparator compares about both the receiving sequence number and the receiving sub sequence number, when the resending identification flag of the sent packet shows "resending", It is a packet communication device comparing only about the receiving sequence number when the resending identification flag shows "un-resending", When the rate of an error generation is low in a communications network, a throughput is earned by enlarging a packet size, and when the rate of an error generation is high, it has the operation that the number of times of resending failure is reducible, by making a packet size small. Hereafter, an embodiment of the invention is described using figures.

[0025](Embodiment 1) Drawing 1 and drawing 2 are the block diagrams of the packet communication device transmission section in an embodiment of the invention, and a receive section. Drawing 3 is a figure showing the packet composition at the time of usual transmission of the variable length packet correspondence procedure in an embodiment of the invention, and the packet composition at the time of resending. Drawing 4 is the format of N (S) field in an embodiment of the invention. Drawing 5 is the format of the sub M (S) field in an embodiment of the invention. Drawing 6 is a figure showing the data flow between the data source of SR (Selective Repeat) method of the variable length packet correspondence procedure in an embodiment of the invention, and a data receiving side.

[0026]In the transmission section which shows drawing 1, 23 is a change-over switch which switches send data. The change-over switch 23 switches so that at least a priority is primacy, retransmits data may be outputted by the 2nd place of a priority and it may output the quantized index of new send data for a request sending message by the 3rd place of a priority about three inputs, respectively (in order to transmit).

[0027]28 is a transmitted data amount measuring means which measures the data volume of send data (data selected with the change-over switch 23), and outputs a transmitted data amount. 29 is error detecting code operation part which calculates the error detecting code of send data (data selected with the change-over switch 23).

[0028]31 is a packet size determination means to determine a packet size based on the existence of a transmitted data amount and the request sending message which received.

[0029]The transmission order number counter which 26 makes a number increase by every [1] whenever send data is inputted by the given packet size value, and outputs a transmission order number, and 25 are the switches inserted in the input signal line of the transmission order number counter 26. When sending retransmits data, it becomes off [the switch 25],

send data (retransmits data) does not pass the switch 25, and the transmission order number counter 26 does not operate.
[0030]46 is a transmitting sub sequence number counter which counts up the transmitting sub sequence number one time whenever send data selected by the given packet size value is inputted, and is outputted as a transmitting sub sequence number counter output value. 45 is the switch inserted in the input signal line of the transmitting sub sequence number counter 46.

[0031]39 is a sequence number preservation memory for resending. If 40 has data of the sequence number applicable when the quantized index of the data to transmit is saved and the sequence number by which request sending was carried out is inputted, it will be a data storage memory for resending which outputs this as retransmits data.
[0032]30 is a multiplexing means which multiplexes send data (data selected with the change-over switch 23), an error detecting code, a transmission order number, and the transmitting sub sequence number based on the packet size outputted from the packet size determination means 31, and is outputted as transmitting multiplexing data.
[0033]27 is a change-over switch which switches the data given to the multiplexing means 30 as a transmission order number. 47 is a switch which switches whether the output data from the transmitting sub sequence number counter 46 is transmitted. 24 is a switch-off substitute discriminating means, and sends a switch-off substitute signal to the switch 23, the switch 25, the change-over switch 27, and the switch 45.
[0034]A baseband processing means by which 32 changes transmitting multiplexing data into baseband data, and 33 are RF modules.
[0035]In the receive section which shows drawing 2, 34 is a separation-ized means to divide reception multiplexing data into an error detecting code, received data, the receiving sequence number, and the receiving sub sequence number. 35 is error detecting code operation part which calculates an error detecting code based on received data, and outputs the error detecting code result of an operation. 36 is a switch.
[0036]37 is an error detecting code comparator which compares the error detecting code and the error detecting code result of an operation which were received, and outputs an error detecting code comparison result.
[0037]38 is a receiving sequence number counter which makes the receiving sequence number increase by every [1] whenever it receives one packet of data, and outputs the receiving sequence number. 48 is a receiving sub sequence number counter with which only the case of "resending" makes the receiving sub sequence number increase by every [1] whenever it receives one packet of data, and it outputs the receiving sub sequence number. This receiving sub sequence number counter 48 does not make the receiving sub sequence number count up, when RIF (resending identification flag) shown in drawing 4 shows "un-

resending." while the "request sending" from the receiving sequence number comparator 41 has inputted -- the receiving sequence number counter 38 and the receiving sub sequence number counter 48 -- neither is counted up.

[0038]41 is a receiving sequence number comparator which compares the receiving sub sequence number (from the separation-ized means 34 to an output) and the receiving sub sequence number of a counter output value which compared the receiving sequence number (from the separation-ized means 34 to an output) and the receiving sequence number of a counter output value which were received, and were received, and outputs a receiving sequence number comparison result. The receiving sequence number comparator 41 compares about both the receiving sequence number and the receiving sub sequence number, when RIF (resending identification flag) shown in drawing 4 shows "resending", and when RIF (resending identification flag) shows "un-resending", it compares only about the receiving sequence number. 44 is a data type identification device.

[0039]36 is a switch which sends the received data inputted by being set to OFF when an error detecting code comparison result is disagreement (mistaking and being), and being set to ON when an error detecting code comparison result is coincidence (with no error) to the next step. 42 is a switch which sends the received data inputted by being set to OFF when a receiving sequence number comparison result is inharmonious, and being set to ON when a receiving sequence number comparison result is coincidence to the next step.

[0040]First, the ARQ (Automatic Repeat Request) error correcting method in an embodiment of the invention is explained using drawing 1 and drawing 2.

[0041]As terminological explanation, a primary station here is an office which is going to transmit data, and a secondary station is an office which receives the data from a primary station and to which a response is returned.

[0042]In drawing 1 and drawing 2, operation in the state where the error has not occurred on a communications network is explained. At this time, in a primary station, neither retransmits data nor a request sending message is inputted into the switch 23 (in order to transmit), but the switch-off substitute discriminating means 24 outputs switch-off substitute signal ** which switches so that the switch 23 may output new send data. The switch 23 switches based on switch-off substitute signal **.

[0043]Switch-off substitute signal ** from which the switch-off substitute discriminating means 24 switches so that the switch 25 may be turned on, Switch-off substitute signal ** which switches so that the change-over switch 27 may output a transmission order number counter output value, and switch-off substitute signal ** which switches so that the switch 45 may be come by off are outputted.

[0044]New send data passes the switch 23 and is inputted into the switch 25, the switch 45, the data storage memory 40 for resending, the transmitted data amount measuring means 28,

the error detecting code operation part 29, and the multiplexing means 30 as selected send data. The switch 25 switches based on switch-off substitute signal **.

[0045]Selected send data passes the switch 25 and is inputted into the transmission order number counter 26. The transmission order number counter 26 counts up a transmission order number one time, whenever send data selected by the given packet size value is inputted, and it outputs it as a transmission order number counter output value. Since selected send data cannot pass the switch 45, it is not inputted into the transmitting sub sequence number counter 46. The change-over switch 27 switches based on the above-mentioned switch-off substitute signal **, and outputs the output value of the transmission order number counter 26 as a transmission order number.

[0046]The data storage memory 40 for resending holds selected send data. The transmitted data amount measuring means 28 measures the data volume of the send data inputted, and outputs a transmitted data amount. The packet size determination means 31 determines a packet size based on a transmitted data amount and the existence of "request sending" which received, and outputs a packet size. The error detecting code operation part 29 calculates the error detecting code of selected send data, and outputs an error detecting code.

[0047]The switch 47 becomes off here based on the above-mentioned switch-off substitute signal **, and the transmitting sub sequence number is not outputted. The multiplexing means 30 multiplexes selected send data, transmission order number, and error detecting code based on the packet size inputted, and outputs them as transmitting multiplexing data. Transmitting multiplexing data is changed into baseband data by the baseband processing means 32, and is changed into an electric wave with RF module 33.

[0048]The electric wave received in the secondary station is changed into baseband data with RF module 33, and is changed into received data by the baseband processing means 32. Next, it explains along with drawing 2.

[0049]Reception multiplexing data is inputted into the separation-ized means 34, and is separation-ized by received data, the received error detecting code, and the receiving sequence number. Received data are inputted into the switch 36 and the error detecting code operation part 35. The error detecting code operation part 35 calculates the error detecting code of a received code, and outputs the error detecting code result of an operation. The error detecting code comparator 37 compares the error detecting code and the error detecting code result of an operation which were received, and when in agreement, the error detecting code comparator 37 outputs "he has no error" as an error existence signal. At this time, the switch 36 serves as one and received data are outputted from the switch 36.

[0050]The received data which passed the switch 36 are inputted into the data type identification device 44 and the switch 43. The data type identification device 44 identifies whether the inputted received data are commands, such as "request sending", and whether it

is the usual commo data, and switches the switch 43 based on this.

[0051]If the inputted received data are commands, such as "request sending", the switch 43 will switch to the upper part, and if it is the usual commo data, the switch 43 will switch to the bottom. Here, since received data are commo data, such as a picture instead of a command, the data type identification device 44 outputs non-command data, the switch 43 switches to the bottom, and received data pass the switch 43 and are sent to the switch 42.

[0052]Only when it mistakes from the error detecting code comparator 37, and the signal of "having no error" is outputted as an existence signal and non-command data are outputted from the data type identification device 44, the receiving sequence number and the comparator 41 operate. Here, the receiving sequence number and the comparator 41 compare about both the receiving sequence number and the receiving sub sequence number, when RIF (resending identification flag) shown in drawing 4 shows "resending." The receiving sequence number and the comparator 41 compare only the receiving sequence number, when RIF (resending identification flag) shows "un-resending."

[0053]Since it is not resending but new data here, only the receiving sequence number compares, The receiving sequence number outputted from the separation-ized means 34 and the receiving sequence number counter output value outputted from the receiving sequence number counter 38 are in agreement, it judges that data has been received normally, and the receiving sequence number and the comparator 41 output the information which shows resending needlessness.

[0054]According to the information which shows the resending needlessness from the receiving sequence number and the comparator 41, it becomes one, received data are outputted from the switch 42, and the switch 42 is sent to the next step. The information which shows resending needlessness simultaneously is sent also to the receiving sequence number counter 38 and the receiving sub sequence number counter 48. In order that RIF (resending identification flag) shown in drawing 4 may show "un-resending", the receiving sequence number counter 38 makes the receiving sequence number count up one time, but the receiving sub sequence number counter 48 does not make the receiving sub sequence number count up.

[0055]Next, in drawing 1 and drawing 2, operation when an error occurs on a communications network is explained. In the receiving operation of a secondary station, the error detecting code comparator 37 compares the error detecting code and the error detecting code result of an operation which were received, and when not in agreement, the error detecting code comparator 37 outputs "mistake and it is" as an error existence signal. When the signal of "mistaking and being" is inputted as an error existence signal, it becomes off [the switch 36] and the received data at this time are discarded. The receiving sequence number comparator 41 does not operate, when this signal of "mistaking and being" is inputted. Thus, request

sending in particular is not performed only by received data being discarded only by the error detecting code comparator 37 taking out the signal of "mistaking and being." When the output signal of the error detecting code comparator 37 changes from "mistake and it is" "for him to have no error", request sending is published as follows.

[0056]The error detecting code and the error detecting code result of an operation which were received by the error detecting code comparator 37 are in agreement, ****** and the switch 36 serve as ["he has no error" and] one, and received data are outputted from the switch 36. Received data are inputted into the data type identification device 44 and the switch 43. Since the received data into which it was inputted also at this time are commo data other than a command, the data type identification device 44 outputs non-command data, it switches to the bottom, received data pass the switch 43, and the switch 43 is inputted into the switch 42.

[0057]The error detecting code comparator 37 outputs "he has no error", and since it is not resending, the receiving sequence number comparator 41 compares only the receiving sequence number. Therefore, the receiving sequence number outputted from the separation-ized means 34 and the receiving sequence number counter output value outputted from the receiving sequence number counter 38 are compared by the receiving sequence number comparator 41.

[0058]Since earlier data is discarded in the error and it is not counting up then at this time, a comparison result is not in agreement. Thus, when a comparison result is not in agreement, the receiving sequence number comparator 41 outputs "request sending."

[0059]Operation of the switch 42 into which "request sending" was inputted, and the treatment of the received data at this time change with a GBN (Go Back N) method or SR (SelectiveRepeat) methods. In the case of a GBN method, the switch 42 serves as OFF, the received data at this time are discarded, in the case of SR method, the switch 42 serves as one, and the received data at this time are connected with data before being saved and having been resent behind, and are used.

[0060]"Request sending" is inputted also into the receiving sequence number counter 38 and the receiving sub sequence number counter 48. while "request sending" has inputted -- the receiving sequence number counter 38 and the receiving sub sequence number counter 48 -- neither is counted up.

[0061]"Request sending" is inputted also into the switch 23 and the switch-off substitute discriminating means 24. Switch-off substitute signal ** which switches so that the switch-off substitute discriminating means 24 may output the "request sending" which the switch 23 transmits at this time, Switch-off substitute signal ** which switches so that the switch 25 may be come by off, switch-off substitute signal ** which switches so that the change-over switch 27 may output a receiving sequence number counter output value, and switch-off substitute signal ** which switches so that the switch 45 may be come by off are outputted.

[0062]The switch 23 switches so that "request sending" may be outputted by switch-off substitute signal **. The "request sending" which transmits passes the switch 23, and is inputted into the switch 25, the switch 45, the data storage memory 40 for resending, the transmitted data amount measuring means 28, the error detecting code operation part 29, and the multiplexing means 30 as selected send data.
[0063]The switch 25 serves as OFF by switch-off substitute signal ** here. The change-over switch 27 switches based on switch-off substitute signal **, and outputs a receiving sequence number counter output value as a transmission order number. The switch 45 is come by off by switch-off substitute signal ** here.
[0064]The transmitted data amount measuring means 28 measures the data volume of the send data inputted, and outputs a transmitted data amount. The packet size determination means 31 determines a packet size based on a transmitted data amount and the existence of "request sending" which received, and outputs a packet size. The error detecting code operation part 29 calculates the error detecting code of selected send data, and outputs an error detecting code.
[0065]The multiplexing means 30 multiplexes selected send data, transmission order number, and error detecting code based on the packet size inputted, and outputs them as transmitting multiplexing data. Transmitting multiplexing data is changed into baseband data by the baseband processing means 32, and is changed into an electric wave with RF module 33. Thus, "request sending" is transmitted from a secondary station to a primary station.
[0066]In the primary station which received "request sending", it operates as follows. The electric wave received in the primary station is changed into baseband data with RF module 33, and is changed into received data by the baseband processing means 32. Reception multiplexing data is inputted into the separation-ized means 34, and is separation-ized by received data, the received error detecting code, and the receiving sequence number. Received data are inputted into the switch 36 and the error detecting code operation part 35.
[0067]The error detecting code operation part 35 calculates the error detecting code of a received code, and outputs the error detecting code result of an operation. The error detecting code comparator 37 compares the error detecting code and the error detecting code result of an operation which were received, and when in agreement, the error detecting code comparator 37 outputs "he has no error" as an error existence signal. At this time, the switch 36 serves as one and received data are outputted from the switch 36. And received data are inputted into the data type identification device 44 and the switch 43.
[0068]The data type identification device 44 identifies whether the inputted received data are commands, such as "request sending", and whether it is the usual commo data, and switches the switch 43 based on this. Here, since the inputted received data are commands "request sending", the switch 43 switches to the upper part.

[0069]The received "request sending" is inputted into the data storage memory 40 for resending, the sequence number preservation memory 39 for resending, and the packet size determination means 31. Although it mistakes from the error detecting code comparator 37 and the signal of "having no error" is outputted as an existence signal, since it is identifying that the data type identification device 44 is command data, the receiving sequence number and the comparator 41 do not operate. For this reason, the switch 42 is off.

[0070]If the received "request sending" is inputted into the sequence number preservation memory 39 for resending, the retransmits data corresponding to the receiving sequence number inputted at this time will be outputted from the data storage memory 40 for resending. Thus, the sequence number preservation memory 39 for resending and the data storage memory 40 for resending are linked to 1 to 1.

[0071]Retransmits data is inputted into the switch-off substitute discriminating means 24. When retransmits data is inputted into the switch-off substitute discriminating means 24, the switch-off substitute discriminating means 24, Switch-off substitute signal ** which switches so that the switch 23 may output retransmits data, Switch-off substitute signal ** which switches so that the switch 25 may be come by off, switch-off substitute signal ** which switches so that the change-over switch 27 may output a receiving sequence number counter output value, and switch-off substitute signal ** which switches so that the switch 45 may be turned on are outputted.

[0072]The switch 23 switches so that retransmits data may be outputted by switch-off substitute signal **, Retransmits data passes the switch 23 and is inputted into the switch 25, the switch 45, the data storage memory 40 for resending, the transmitted data amount measuring means 28, the error detecting code operation part 29, and the multiplexing means 30 as selected send data.

[0073]The switch 25 is off, selected send data (retransmits data) cannot pass the switch 25, and the transmission order number counter 26 does not operate. The change-over switch 27 outputs a receiving sequence number counter output value as a transmission order number according to switch-off substitute signal **. It becomes one, selected send data is outputted by switch-off substitute signal ** from the switch 45, and the switch 45 is sent to the transmitting sub sequence number counter 46.

[0074]At the time of the data transmission for resending, the data storage memory 40 for resending does not perform rewriting operation. The transmitted data amount measuring means 28 measures the data volume of the send data inputted, and outputs a transmitted data amount. The packet size determination means 31 determines and outputs a packet size based on a transmitted data amount and the existence of request sending which received.

[0075]The packet size determination means 31 chooses a packet size smaller than the packet size which generally transmitted before from the received "request sending" being inputted.

That is, retransmits data is divided, and a resending packet is constituted and resent. The transmitting sub sequence number counter 46 counts up the transmitting sub sequence number one time, whenever send data selected by the given packet size value is inputted, and it outputs it as a transmitting sub sequence number counter output value.

[0076]Since the switch 47 switches based on switch-off substitute signal ** and the receiving sequence number counter output value is outputted from the change-over switch 27, it becomes one and the transmitting sub sequence number is outputted here.

[0077]The error detecting code operation part 29 calculates the error detecting code of selected send data, and outputs an error detecting code. The multiplexing means 30 multiplexes selected send data, transmission order number, transmitting sub sequence number, and error detecting code based on the packet size inputted, and outputs them as transmitting multiplexing data. At this time, the multiplexing means 30 sets RIF (resending identification flag) shown in drawing 4 as "resending", and if there is retransmits data following the data which it is going to resend now, it will set REF (resending ending flag) shown in drawing 5 as "resending un-ending." Transmitting multiplexing data is changed into baseband data by the baseband processing means 32, and is changed into an electric wave with RF module 33.

[0078]Thus, the response data to "request sending" is transmitted from a primary station to a secondary station. The transmitting side of a primary station operates similarly until transmission of a series of retransmits data is completed. And when transmitting the data of the last of continuous retransmits data, it is notified to a secondary station that it is a packet of the last of a series of divided retransmits data by setting REF (resending ending flag) shown in drawing 5 as "an end of resending."

[0079]The electric wave received in the secondary station is changed into baseband data with RF module 33, and is changed into received data by the baseband processing means 32. Reception multiplexing data is inputted into the separation-ized means 34, and is separation-ized by received data, the received error detecting code, and the receiving sequence number. Received data are inputted into the switch 36 and the error detecting code operation part 35. The error detecting code operation part 35 calculates the error detecting code of a received code, and outputs the error detecting code result of an operation. The error detecting code comparator 37 compares the error detecting code and the error detecting code result of an operation which were received, and when in agreement, the error detecting code comparator 37 outputs "he has no error" as an error existence signal. At this time, the switch 36 serves as one and received data are outputted from the switch 36.

[0080]Received data are inputted into the data type identification device 44 and the switch 43. The data type identification device 44 identifies whether the inputted received data are commands, such as "request sending", and whether it is the usual commo data, and switches

the switch 43 based on this. Here, since the inputted received data are not commands, it switches to the bottom, received data pass the switch 43, and the switch 43 is inputted into the switch 42.

[0081]As mentioned above, only when it mistakes from the error detecting code comparator 37, and the signal of "having no error" is outputted as an existence signal and non-command data are outputted from the data type identification device 44, the receiving sequence number and the comparator 41 operate. Operation of the receiving sequence number and the comparator 41 compares about both the receiving sequence number and the receiving sub sequence number, when RIF (resending identification flag) shown in drawing 4 shows "resending", and when RIF (resending identification flag) shows "un-resending", only the receiving sequence number compares. Since it is resending of commo data here, comparison of both the receiving sequence number and the receiving sub sequence number is performed, The receiving sequence number outputted from the separation-ized means 34 and the receiving sequence number counter output value outputted from the receiving sequence number counter 38 are in agreement, And if the receiving sub sequence number and the receiving sub sequence number counter 48 which are outputted from the separation-ized means 34 are in agreement, it will judge that data has been received normally, and the receiving sequence number and the comparator 41 output the information which shows "resending needlessness." If the receiving sequence number and the comparator 41 output the information which shows "resending needlessness", the switch 42 will serve as one and received data will be outputted from the switch 42.

[0082]The information which shows "resending needlessness" simultaneously is inputted into the receiving sequence number counter 38 and the receiving sub sequence number counter 48. In order that RIF (resending identification flag) shown in drawing 4 may show "resending" at this time, the receiving sub sequence number counter 48 makes the receiving sub sequence number count up one time. In order that REF (resending ending flag) shown in drawing 5 may show "resending un-ending", the receiving sequence number counter 38 does not make the receiving sequence number count up.

[0083]Thus, the retransmits data from a primary station to a secondary station is received. The receiver of a secondary station operates similarly until reception of a series of retransmits data is completed. And when REF (resending ending flag) shown in drawing 5 receives the packet set as "the end of resending", it recognizes having received the packet of the last of a series of divided retransmits data. In order that RIF (resending identification flag) shown in drawing 4 may show "resending" at this time, the receiving sub sequence number counter 48 makes the receiving sub sequence number count up one time. In order that REF (resending ending flag) shown in drawing 5 may show "the end of resending", the receiving sequence number counter 38 makes the receiving sequence number count up one time. Then, if an error does not occur

on a communications network, it changes to the usual communicating state.

[0084]The case where variable length packet communication is performed using SR method with such an ARQ error correcting method is explained using drawing 6. When an error occurs in the packet of transmission order number N(S) =5, when a data receiving side receives the packet of following transmission order number N(S) =6, it detects sequence number disagreement, and transmits request sending (Selective Reject) to a data source. The packet of N(S) =9 is stored temporarily from transmission order number N(S) =6 received by the data receiving side by the time the data source received request sending (Selective Reject).

[0085]When a data source receives request sending (SelectiveReject), he divides the packet of transmission order number N(S) =5 of a basis (here, it trichotomizes), and adds and resends transmitting sub sequence number M(S) =0, M(S) =1, and M(S) =2 to each. The figure showing the situation of the division at this time is drawing 3.

[0086]It is divided, and it is a format as shown in drawing 4, "resending" is set up, and RIF (resending identification flag) of N (S) field of the packet which the transmitting sub sequence number is added and is resent is sent. And REF (resending ending flag) of the M(S) M [sub / of the packet of =0 and M(S) =1] (S) field, In a format as shown in drawing 5, "resending un-ending" is set up and, as for REF (resending ending flag) of the sub M (S) field of the packet of M(S) =2, "an end of resending" is set up.

[0087]It is recognized as resending having ended the data receiving side, when it is recognized as resending having been started from the time of the ability of RIF (resending identification flag) of N (S) field to receive the packet which shows "resending" and REF (resending ending flag) of the sub M (S) field has received "the end of resending." The packet of sub sequence number M(S) =0 received in the meantime, M(S) =1, and M(S) =2 is connected, and the packet of N(S) =5 is constituted. And while connecting the packet of this sequence number N(S) =5 with sequence number N(S) =4, the packet of N(S) =9 is connected after the packet of N(S) =5 from N(S) =6 stored temporarily.

[0088]Thus, according to the variable length packet correspondence procedure of this invention, also when performing the ARQ (Automatic Repeat Request) error correction of SR (Selective Repeat) method, variable length packet communication can be performed.

[0089]

[Effect of the Invention]Also when performing the ARQ (Automatic Repeat Request) error correction of SR (Selective Repeat) method according to this invention so that clearly from the above explanation, By variable length packet communication being attained, the number of times of resending failure is reducible by earning a throughput by enlarging a packet size, when the rate of an error generation is low in a communications network, and making a packet size small, when the rate of an error generation is high.

[Translation done.]